

Novel Photonic Waveguide Structures for Chip-Scale Photonic Integrated Circuits

Abstract

The present invention discloses a concept of natural index contrast (NIC) for producing photonic waveguides and methods of fabrication thereof. Such waveguide forms the basis of a class of chip-scale micro- and nano-photonic integrated circuits (PICs). The NIC method utilizes the built-in refractive index difference between two layers of dielectric thin films of two different materials, one laid on top of another. This new class of waveguides simplifies the PIC fabrication process significantly. Based on the NIC based waveguides, PICs can be fabricated for a number of photonic applications such as arrayed waveguide grating (AWG), reflective arrayed waveguide grating (RAWG), interleaver, interferometer, and optical sensor. Additionally, several other PICs can also be fabricated via tiers of integration, such as triple-phase integration. Examples of such devices include optical amplifier, wavelength router, sensor, optical modulator, transmitter, receiver, transponder, fully built dense wavelength division multiplexer and demultiplexer, optical power splitter, multichannel tunable optical attenuator, and multichannel tunable optical add-drop multiplexer. Unlike hybrid integration, triple-phase integration monolithically integrates multiple optical functionalities on a single chip.